NORTH GAWBER COLLIERY SITE

REMEDIAL EARTHWORKS OPERATIONS

Summary of Proposals

BACKGROUND INFORMATION

Site Description

The North Gawber Colliery Site comprises informal open space with areas of colliery spoil, dereliction, demolition rubble, immature birch plantation, scrub and marshland on a series of broad terraces forming a variable slope with high ground in the north and low-lying terrain in the south (**Figure 1**). The ground surface on the terraces is reasonably level, but the side slopes fall away quite steeply at gradients of between 1 in 4 and 1 in 15. Surface water run-off is generally directed to the south and numerous deep erosion gullies have formed in the colliery spoils. An area of marshy ground has developed in the south-west of the site, although surface drainage is mainly to the south-east.

Historical Development

The site is underlain by a number of coal seams including the Kent's Thick and Barnsley seams which were mined underground at the North Gawber Colliery from at least 1849 onwards. The colliery buildings and associated coke ovens were constructed in the north-east of the site. Five recorded shafts were sunk within the vicinity of the site to access the deep workings. Three known adits were opened up into the Kent's Thick seam which is at relatively shallow depth and outcrops through the middle of the site. A mineral railway with rail sidings crossed the site from Spark Lane in the west to Carr Green Lane in the east. The original North Gawber Colliery closed in 1922 but a new colliery opened in its place in 1926. Many of the former buildings (including the coke ovens) were largely demolished at this time and replaced by the construction of newer facilities and structures.

During the lifetime of the mine, colliery spoils were tipped in spoil heaps which were gradually extended southwards beyond the mineral railway. Parts of the tips were used as coal stocking grounds. During the 1930's or 1940's an aerial ropeway was erected to take excess spoils from the colliery to a large tip located south of the site. Sometime in the 1960's a conveyor was built to take additional spoil to another tipping area located further east of the site. In the 1950's to 1970's several sets of lagoons were formed within the low-lying ground in the south of the site, including some on opencast backfill above a small surface mine that was opened up in 1974 on the outcrop of the Kent's Thick seam.

The North Gawber Colliery was eventually closed in 1988. Following this, considerable changes took place including the subsequent demolition and removal of the colliery buildings, dismantling of the railway and conveyor, reclamation of the spoil heap in the north-west of the site to create a football pitch, backfilling of the slurry lagoons, reclamation of the tip to the south and construction of new industrial units on land to the north and south-east of the site.

Contamination Assessment

Recent ground investigations have confirmed elevated levels of arsenic in the made ground deposits (colliery spoil) across the whole site. Elevated levels of sulphates and generally acidic conditions also

exist in these materials over much of the site. Tests indicate that the colliery discards are potentially combustible. Localised areas of hydrocarbon contamination were identified in made ground in selected parts of the site. A grouping of samples in the north-east with elevated PAH's (polycyclic aromatic hydrocarbons) is attributed to the presence of bituminous materials which were found mixed up in the made ground deposits. No evidence of significant contamination has been discovered anywhere on the site which would relate to typical waste products from the former coke works.

No significant contamination has been found in the glacial till underlying the made ground deposits. However, isolated occurrences of elevated metals and hydrocarbons were identified in a small number of samples which suggest some localised leaching of contaminants out of the made ground.

Groundwater across the site was found to contain elevated levels of sulphates. Elevated metals and low pH values were identified in more localised areas. Hydrocarbons were noted to be present in some groundwater samples, but not at significant levels based on the most recent investigations. No significant contamination has been recorded in the surface waters.

MAIN DEVELOPMENT CONSIDERATIONS

Topography

The variably sloping ground surface with its broad terraces and often steep side slopes does not naturally lend itself to the development of the site for residential housing. In order to provide a development area suitable for the construction of houses, an extensive cut and fill earthworks operation is required to create a gradual fall from north to south across the site.

Obstructions

Following demolition of the colliery buildings at the site, areas of hardstanding and several concrete structures are still present at the surface, as well as remnant brick and reinforced concrete foundations and sub-structures left in the ground which, for the most part, are substantial and deep. The made ground generally includes significant quantities of demolition waste, much of which is of a combustible nature. All such obstructions will have to be removed as part of the development of the site and the resulting excavations backfilled with engineered fill.

Contamination

Localised PAH contamination has been identified in the north-east of the site which will need to be treated separately from all other materials. The made ground deposits in these areas will be excavated out and screened to remove all over-sized material then placed in temporary stockpiles for sampling and confirmatory chemical analysis. Subject to the findings of these analyses, it may be possible to re-introduce the materials back into the site as fill or, alternatively, remediate them to reduce the PAH concentrations to an acceptable level for human health. The resulting excavations will be validated to ensure no remnant contamination is left in the ground and then backfilled with engineered fill.

With regard to the potential combustibility of the colliery discards present in the spoil, the standard technique to safeguard against any possible risks of combustion is to place a 1m thick soil cap over these materials. This soil cap should also be sufficient to protect end-users from contamination in the made ground deposits.

SCOTT DOHERTY

Mine Workings

The Kent's Thick seam extends beneath the northern half of the site and contains relatively shallow mine workings within influencing distance of the surface. These could give rise to subsidence caused by collapse above any remaining voids unless suitable remedial action is taken to stabilise the ground. Mine abandonment plans show where most of the workings are located, although some additional mine workings have been identified by drilling which were previously unrecorded. The Barnsley seam has also been extensively worked but lies approximately 60m below the Kent's Thick and is too deep to influence ground conditions at the surface.

REMEDIAL EARTHWORKS OPERATIONS

Before the site is developed for residential housing it will be necessary to carry out preparatory earthworks involving a cut and fill operation to remove all obstructions in the ground, deal with the localised areas of contamination and establish a suitable construction platform with an even gradient across the site. These operations will be undertaken by a specialist contractor under the supervision of SDA. Heavy duty plant may be required to remove the remnant foundations and sub-structures where present and to excavate into competent bedrock as necessary to achieve the required profile.

A ground model for the cut and fill earthworks has been prepared by SDA at an overall grade of 1 in 17 (3.3°) which will achieve an almost neutral cut/fill balance across the site. The proposed profile of the final post-earthworks ground surface is shown in **Figure 2**. A number of accompanying cross-sections which indicate how the cut and fill profile will vary across the site are included as **Figure 3**. The size and distribution of the cut and fill areas are further illustrated in **Figure 4** which shows a series of isopachytes representing the depths of cut and thicknesses of fill that are proposed.

The cut and fill operations have been designed to provide a gradual fall from north to south across the site by reducing ground levels in the north and raising them in the south using the fill generated from the cuttings in the north. Around the northern edge of the site a bank will be excavated at a gradient of 1 in 2 and no more than 3m high adjacent to the site boundary and power lines in the area (with suitable stand-off distances from these features) to form the start of the overall slope. The southern end and western edge of the slope will be tied back down to existing ground levels along the margins of the ecological amenity area with a bank up to 4.5m high at a 1 in 2 gradient.

With reference to **Figure 4**, the maximum depth of cut will be approximately 6m down through the football pitch in the north-west of the site. Elsewhere, up to 4m of cut will have to be taken from the shoulders of the terraced spoil in the north-east site quadrant. The main areas of fill will be in the south and south-west (up to a maximum of just over 5m), with a substantial amount of shallow fill (up to 2m thick) to be placed on the spoil terrace that runs through the centre of the site and which formed the course of the old railway.

Materials used in the earthworks will comprise mainly coarse colliery discards which should be suitable for re-use in the works as engineered fill, so long as they are compacted in accordance with a detailed specification and under proper supervision and control. In line with their own guidance, the Environment Agency has confirmed that the colliery discards do not constitute 'waste' and as such the movement and re-use of these materials will not require a Waste Management Licence, neither is an exemption required.

An appreciable amount of secondary aggregates may also be available from the re-processing of remnant brick and concrete foundations, sub-structures and areas of hardstanding. These materials should also be suitable for re-use in the earthworks provided they are isolated below the 1m soil cap which will be placed on top of them.

The earthworks operations will be supervised by an experienced environmental scientist and a 'watching brief' maintained to look out for any previously undiscovered areas of contamination. If any contamination is identified all impacted materials will be separately excavated and stockpiled to allow further assessment.

Following completion of the cut and fill operations, trial pits will be excavated on a regular grid into the development platform and samples taken for chemical analysis. Pending the findings of the analyses, it may be necessary to carry out a further Detailed Quantitative Risk Assessment (DQRA) to confirm the suitability, or otherwise, of the proposed soil cap.

The shallow mine workings (including the shafts and adits) will be treated by drilling and grouting to fill the void spaces and strengthen the ground in advance of construction. These operations will be carried out following the preparatory earthworks and will involve injecting a suitable cement-based grout through boreholes on a regular 3m grid to fill the voids within the workings. Secondary infill holes on a 1.5m grid may be required in areas of high grout take. A grout curtain may be required around the perimeter of the treatment zone, the area of which is estimated to be about 4.3 hectares. A reinforced concrete cap will be constructed over any untreated mine shafts. The remedial works to the mine adits will typically comprise sealing the entrance with brick or concrete and infilling the adit itself with grout via boreholes drilled into the roof.